

## TENT COOPERATION TRE, /

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

Date of mailing (day/month/year) 21 November 2000 (21.11.00)	
International application No. PCT/GB00/00617	Applicant's or agent's file reference N.75807A MN
International filing date (day/month/year) 21 February 2000 (21.02.00)	Priority date (day/month/year) 01 March 1999 (01.03.99)
Applicant BRADY, John, Michael et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
 21 September 2000 (21.09.00)

☐ in a notice effecting later election filed with the International Bureau on:  
 \_\_\_\_\_

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Juan Cruz Telephone No.: (41-22) 338.83.38
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## P/ INT COOPERATION TREA

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

NICHOLLS, Michael, John  
J.A. Kemp & Co.  
14 South Square  
Gray's Inn  
London WC1R 5LX  
ROYAUME-UNI

Date of mailing (day/month/year) 23 August 2001 (23.08.01)	<b>IMPORTANT NOTIFICATION</b>
Applicant's or agent's file reference N.75807A MN	
International application No. PCT/GB00/00617	International filing date (day/month/year) 21 February 2000 (21.02.00)

## 1. The following indications appeared on record concerning:

☒ the applicant
                 
 ☐ the inventor
                 
 ☐ the agent
                 
 ☐ the common representative

## Name and Address

 ISIS INNOVATION LIMITED  
 Ewert House  
 Ewert Place  
 Summertown  
 Oxford OX2 7BZ  
 United Kingdom

## State of Nationality

GB

## State of Residence

GB

## Telephone No.

## Facsimile No.

## Teleprinter No.

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person
                 
 ☐ the name
                 
 ☐ the address
                 
 ☐ the nationality
                 
 ☐ the residence

## Name and Address

 MIRADA SOLUTIONS LIMITED  
 Oxford Centre for Innovation  
 Mill Street  
 Oxford  
 Oxfordshire OX2 OJX  
 United Kingdom

## State of Nationality

GB

## State of Residence

GB

## Telephone No.

## Facsimile No.

## Teleprinter No.

## 3. Further observations, if necessary:

## 4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

 The International Bureau of WIPO  
 34, chemin des Colombettes  
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

## Authorized officer

Marie Victoria CORTIELLO

Telephone No.: (41-22) 338.83.38

# PATENT COOPERATION TREATY

## PCT

REC'D 01 JUN 2001

WIPO PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference N.75807A MN	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/00617	International filing date (day/month/year) 21/02/2000	Priority date (day/month/year) 01/03/1999
International Patent Classification (IPC) or national classification and IPC G06T5/00		
Applicant ISIS INNOVATION LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 10 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  21/09/2000	Date of completion of this report  30.05.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Müller, M  Telephone No. +49 89 2399 7409



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00617

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
- Description, pages:**

1-33 as originally filed

**Claims, No.:**

1-66 as originally filed

**Drawings, sheets:**

1/17-17/17 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00617

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.  
☐ paid additional fees.  
☐ paid additional fees under protest.  
☒ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.  
☒ not complied with for the following reasons:  
**see separate sheet**

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.  
☒ the parts relating to claims Nos. 1-34.

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-34
	No: Claims
Inventive step (IS)	Yes: Claims 11-12, 14, 16, 20-22, 26-28, 32-34
	No: Claims 1-10, 13, 15, 17-19, 23-25, 29-31

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Industrial applicability (IA)    Yes:    Claims    1-34  
   No:    Claims

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/00617

**Citations**

Reference is made to the following document:

D1: MITSUO OHTA ET AL: 'A RESTORATION METHOD OF MEDICAL X-RAY IMAGES BASED ON AN EXTENDED REGRESSION ANALYSIS METHOD' SYSTEMS & COMPUTERS IN JAPAN, US, SCRIPTA TECHNICA JOURNALS. NEW YORK, vol. 22, no. 13, 1 January 1991, pages 104-116

**IV: Lack of unity of invention**

- 1 The present international application is considered to comprise four different inventions, namely the second invention according to the international search report ISR (independent claims 35, 41 and 47) and three inventions that were jointly referred to as the "first invention" in the ISR (claims 1,4 and 7; 10, 13 and 15; 17, 23 and 29).
- 1.1 Independent claims 1, 4, 7, 10, 13, 15, 17, 23 and 29, and associated dependent claims concern *image enhancement* (or image analysis in order to support image enhancement), specifically by using a modulation transfer function (Claims 1, 4, 7), by "fitting a theoretical model" and comparing it with measurements (Claims 10, 13, 15), and by using a deconvolution to remove glare from an image (Claims 17, 23, 29). More specifically:
  - 1.1.1 Claims 1, 4 and 7 correct for image degradation (especially digitiser blur) of an x-ray image by operating not on the pixel values (P) related to the film density but on the derived intensities (T) of the attenuated light - by "applying a modulated transfer function" (pages 11, 12).
  - 1.1.2 Claims 10, 13 and 15 are concerned with computing, in an x-ray imaging context, the energy imparted to the intensifying screen (E) from the image density (D) - using a "theoretical model of the expected response to the measured response" (pages 12-14).
  - 1.1.3 Claims 17, 23 and 29, in the same context, specify removal of glare contributed by the intensifying screen by operating on a representation of the

energy imparted to said screen - specifically, by "deconvolving [it] using a weighting mask defining the [corresponding] point spread function" (page 14 ff).

1.2 Independent claims 35, 41 and 47 and associated dependent claims concern the analysis of a mammogram in order to delimit the region containing the compressed part of the breast by detecting the smoothness of curves of equal intensity in the mammogram.

1.3 The only common subject-matter of the claims of groups 1.1 and 1.2 is their distant relationship as image processing operations which does not, of course, represent a special technical feature common to both.

None of the operations used according to group 1.1 is by any means related to the detection of the smoothness of curves as used in group 1.2.

Moreover, the image enhancement operations according to group 1.1 are substantially unrelated to the detection of certain breast regions according to invention 1.2. While a combination may be advantageous in the current case, each invention can be used separately for its very purpose, and in combination with other image processing routines.

1.4 The three groups 1.1.1 - 1.1.3 are concerned with the enhancement of an x-ray image. This is as such a well-known goal as witnessed by the papers by the inventors cited on pages 3 and 4, as well as by D1.

Moreover, claims 10, 13 and 15 and claims 17, 23 and 29 have in common that the image densities are converted into a representation of the energy imparted to the screen. However, it is considered that the method to compute said representation (eg, according to claim 10) and the use of said representation (eg, according to claim 17) are not interdependent. Rather, the method of claim 10 does not imply said use, nor does the method of claim 17 necessitate a specific way of computing said representation.

The three groups of claims refer to different steps in a more complex method as summarized on page 11 in the description: Claims 1, 4 and 7 relate to steps 1 and 2, claims 10, 13 and 15 to step 3, and claims 17, 23 and 29 to step 4 (cf also description pages 11-17).

The mere fact that several steps are to be combined in a complex method



**INTERNATIONAL PRELIMINARY  
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does, however, not imply their unity if the steps are not functionally related. In the present case, for instance, it would seem that omission of step 2 would not substantially affect steps 3 and 4, and that a different implementation of either one of steps 3 and 4 would not affect the other one.

- 1.5 In summary, there is no special technical feature common to all independent claims of any two groups 1.1.1 - 1.1.3 and 1.2 which would represent a single general inventive concept linking them with each other.
- 1.6 As a consequence, the application does not comply with the requirement of unity of invention according to Rule 13 PCT.
- 2 *This invention deals with claims 1-34 only as these claims represented the "first invention" according to the ISR. Notably, an assessment is given for all claims of said "first invention", not withstanding the above consideration that these claims are, as a whole, non unitary.*

**V: Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

- 3 Novelty and inventive step are assessed under the proviso of the objections raised under item VIII below.
- 4 At present, document D1 appears to represent the closest piece of prior art.
- 4.1 In general terms, D1 addresses (see, page 106, left, lines 18-27) the removal of optical blur by applying in the reverse order to the output image the transfer characteristics of the laser scanner (cf, the "modulation transfer function" of claim 1), the characteristics curve of the film (as computed, eg, according to claim 10), the logarithmic transformation of the optical density (cf, eg, claim 1 and page 12, line 9), and an inverse filter based on the point spread function of the radiographic screen-film system (cf, the "deconvolution" of claim 17).
- 4.2 More specifically, D1 discloses a method of correcting a digital representation of

an x-ray image for degradation caused by a digitiser, the digital representation being a measurement of the image density for each of a plurality of pixels of the image, the measurement being obtained by illuminating the image, measuring the attenuation of the light by the image and calculating from the attenuated light values the image density (eg, summary and figure 1), the method comprising the steps of

calculating (section 2) from the optical density ( $z_{ij}$ ) corresponding to the pixel values in the digital representation the value of intensity of said attenuated light (the relative exposure  $\xi_{ij}$ ) corresponding to each pixel (page 109, left, lines 20-25 below eq. 4), and

applying to the intensity values a modulation transfer function (ibid., lines 31-34) to correct for the degradation introduced by the digitiser (ibid., equation 5 yielding the exposure patterns  $\eta_{ij}$ ).

- 4.2.1 The transformation from pixel values to optical density values ( $z_{ij}$  to  $z'_{ij}$ ) is not explicitly addressed in D1 but the relation is disclosed (G; eq. 4) and its inversion is normally simple (cf, page 9, lines 26-29, of the description).
- 4.2.2 Moreover, D1 provides a clear indication as to how the pixel values ( $z_{ij}$ ) can be reconstructed from the exposure patterns ( $\eta_{ij}$ ; cf. eqs. 2-4). It would thus be obvious for the skilled person how to convert the corrected intensity values back into values representative of the image intensity.
- 4.2.3 In summary, the subject matter of claim 1 does not appear to involve an inventive step over the disclosure of D1, in violation of Article 33 (3) PCT), and the same argument holds, mutatis mutandis, for claims 4 and 7 as well.
- 4.2.4 With respect to claims 2, 5 and 8 it is noted that D1 is in fact directed towards the removal of optical blur (loc. cit), and with respect to claims 3, 6 and 9 it should be noted that D1 does not disclose the specific formula specified but does disclose a "logarithmic relationship" between optical density and relative exposure (figures 3 and 4; page 109, left, lines 20-22).
- 4.3 Ad claims 10, 13 and 15: D1 discloses a method for fitting a theoretical model (a 7th or 8th order polynomial) of the expected response of the x-ray film (figure 1) to

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/00617

a plurality of different intensities of received x-rays to a measured response (figures 3 and 4), and using the fitted theoretical model to calculate imparted energy from the image density (page 108, eq. 3 and following 2 lines).

- 4.3.1 While no calibration is explicitly mentioned in D1, it is clear to the skilled person that the determination of the central function  $F$  (see eq. 3) is indeed a form of calibration for the purpose of the method of D1.
- 4.3.2 Therefore, it is considered that claims 10, 13 and 15 also lack an inventive step over D1, in violation of Article 33 (3) PCT.
- 4.4 In contrast, the specific model specified in claims 11, 14 and 16 is not disclosed or unambiguously suggested in any of the prior art documents. Nor is the use of a lucite step wedge filter according to claim 12 for the calibration task to hand.
- 4.5 Ad claims 17-19, 23-25 and 29-31: D1 also discloses (section 2) a transformation of the digital representation of the optical densities ( $z_{ij}$ ) into a representation of the relative exposure (ie, energy:  $\xi_{ij}$ ) and then deconvolving (cf, eqs 2 and 5 and the 3 lines preceding eq 2) said representation of relative exposure using a weighting mask (b) defining the point spread function (page 109, left, lines 25 ff) to remove blur. Moreover, it is clear that the point spread function of an optical material is a function in all three dimensions, ie that it depends on both distance (claims 18, 24 and 30) and depth (claims 19, 25 and 31).
- 4.6 In contrast, none of the prior art documents discloses or suggests the specific criterion given in claims 20, 26 and 32 to actually detect noise regions.
- Said claims are, hence, considered to meet the dispositions of Article 33 (1-3) PCT. By dependency, the same assessment applies to claims 21-22, 27-28 and 33-34 as well.

**VII: Certain defects in the international application**

- 5 Document D1 should have been acknowledged in the description and its relevant contents should have been briefly discussed (Rule 5.1 (a) (ii) PCT).

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- 6 The independent claims should have been drafted in two-part form based on document D1 as the closest piece of prior art or, alternatively, on the basis of the paper cited on page 4 (lines 18-23) of the description as its disclosure is explicitly stated to have been the starting point for the present invention (Rule 6.3 (b) PCT).
- 7 The claims do not contain reference signs, in contrast to the requirements of Rule 6.2 (b) PCT.

**VIII: Certain observations on the international application**

- 8 Independent claims 10 and 17 are unclear (Article 6 PCT) for classifying their subject method as "In a method for doing X a method for doing Y". Such phrasing renders unclear whether or not the features of the method for doing X are limiting with respect to the method for doing Y. It is suggested to use alternative wording such as "a method for doing X further comprising the following steps for doing Y".
- 9 In claims 1, 4 and 7 the indeterminate article "a" for referring to the used "modulated transfer function" is considered inappropriate and renders the claims unclear. It should be made explicit which function (or which sort of function) is in fact used and what aspects of which parts of the recited optical system it models.
- 10 In claims 17, 23 and 29 it would seem that "screen" and "intensifying screen" refer to the same entity. If this is indeed intended, "screen" should be replaced by "intensifying screen" for clarity reasons.

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>N. 75807A MN</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 00617</b>	International filing date (day/month/year) <b>21/02/2000</b>	(Earliest) Priority Date (day/month/year) <b>01/03/1999</b>
Applicant <b>ISIS INNOVATION LIMITED et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 5 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☒ Unity of invention is lacking (see Box II).

## 4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

## 5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

## 6. The figure of the drawings to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1



None of the figures.

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB 00/00617

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-34

Correcting a digital X-ray image for degradation caused by the digitizer Modulation Transfer Function

2. Claims: 35-66

Calculation of the compressed thickness of a breast from a mammogram

## INTERNATIONAL SEARCH REPORT

International Application No

P 00/00617

**A. CLASSIFICATION OF SUBJECT MATTER**  
**IPC 7 G06T5/00**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
**IPC 7 G06T**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**WPI Data, PAJ, EPO-Internal, INSPEC**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MITSUO OHTA ET AL: "A RESTORATION METHOD OF MEDICAL X-RAY IMAGES BASED ON AN EXTENDED REGRESSION ANALYSIS METHOD" SYSTEMS & COMPUTERS IN JAPAN,US,SCRIPTA TECHNICA JOURNALS. NEW YORK, vol. 22, no. 13, 1 January 1991 (1991-01-01), pages 104-116, XP000262414 ISSN: 0882-1666 abstract	1,2,4,5, 7,8,10, 12,13, 15,17, 20,23, 26,29,32
A	paragraph '0002! - paragraph '0004!; figures 3,4 -/--	3,6,9, 11,14, 16,18, 19,21, 22,24, 25,27, 28,30, 31,33,34

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

**17 July 2000**

Date of mailing of the international search report

**26. 07. 2000**

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

**Gonzalez Ordonez, 0**



## INTERNATIONAL SEARCH REPORT

International Application No

P 00/00617

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>-----</p> <p>US 4 907 288 A (SHIMONI YAIR) 6 March 1990 (1990-03-06)</p>	1,2,4,5, 7,8,10, 12,13, 15,23,29
A	<p>abstract</p> <p>column 2, line 21 - line 29</p> <p>-----</p>	3,6,9, 11,14, 16-22, 24-28, 30-34
A	<p>US 5 760 403 A (ELABD HAMMAM) 2 June 1998 (1998-06-02) abstract column 6, line 47 -column 7, line 60</p> <p>-----</p>	1-34
A	<p>MOODY E B: "DISCRETE ORTHOGONAL POLYNOMIAL RESTORATION OF IMAGES DEGRADED BY SPATIALLY VARYING POINT SPREAD FUNCTIONS" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON IMAGE PROCESSING (ICIP),US,LOS ALAMITOS, IEEE COMP. SOC. PRESS, vol. CONF. 1, 1994, pages 680-684, XP000522708 ISBN: 0-8186-6952-7 abstract paragraph '000I! paragraph '00II!</p> <p>-----</p>	1-34
A	<p>EP 0 788 070 A (EASTMAN KODAK CO) 6 August 1997 (1997-08-06) abstract</p> <p>-----</p>	1-34
A	<p>US 5 572 565 A (ABDEL-MOTTALEB MOHAMED) 5 November 1996 (1996-11-05) abstract column 4, line 9 - line 24 column 6, line 31 - line 47 column 7, line 30 - line 32</p> <p>-----</p>	35-66
A	<p>US 4 763 343 A (YANAKI NICOLA E) 9 August 1988 (1988-08-09) abstract column 7, line 1 - line 21</p> <p>-----</p>	35-66
A	<p>US 5 757 880 A (COLOMB DENIS) 26 May 1998 (1998-05-26) abstract column 2, line 36 - line 59 column 4, line 56 -column 5, line 20</p> <p>-----</p>	35-66

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International Application No

PCT/GB 00/00617

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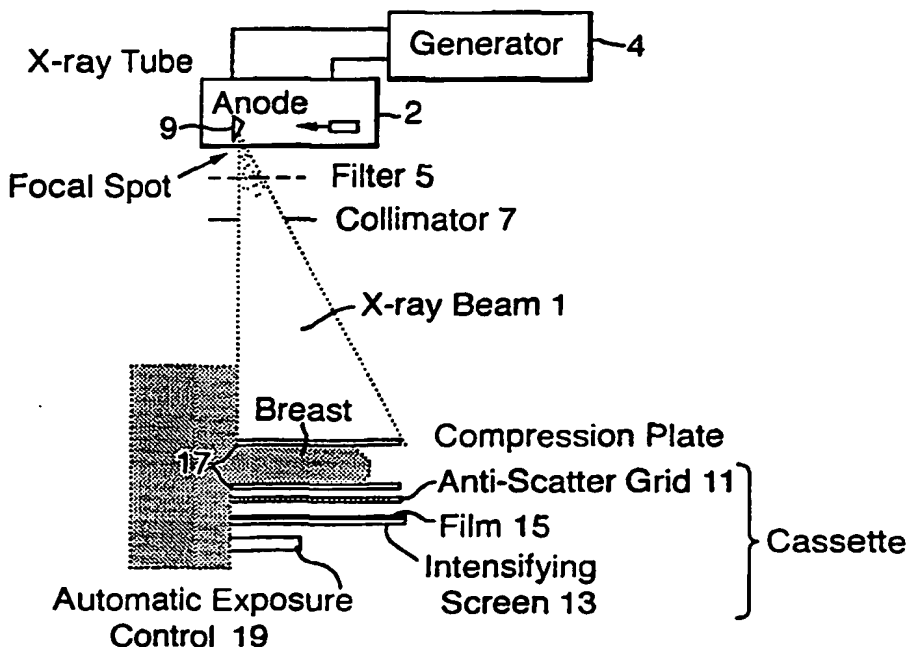
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> : <b>G06T 5/00</b>		A1	(11) International Publication Number: <b>WO 00/52641</b>
			(43) International Publication Date: 8 September 2000 (08.09.00)
(21) International Application Number: PCT/GB00/00617		(81) Designated States: JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) International Filing Date: 21 February 2000 (21.02.00)			
(30) Priority Data: 9904692.2 1 March 1999 (01.03.99) GB		Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	
(71) Applicant (for all designated States except US): ISIS INNOVATION LIMITED [GB/GB]; Ewert House, Ewert Place, Summertown, Oxford OX2 7BZ (GB).			
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(74) Agents: NICHOLLS, Michael, John et al.; J.A. Kemp & Co., 14 South Square, Gray's Inn, London WC1R 5LX (GB).			

(54) Title: X-RAY IMAGE PROCESSING

(57) Abstract

A method of enhancing and normalising x-ray images, particularly mammograms, by correcting the image for digitizer blur, glare from the intensifying screen and the anode-heel effect. The method also allows the calculation of the compressed thickness of the imaged breast and calculation of the contribution to the mammograms of the extra focal radiation. The correction of the image for glare from the intensifying screen allows the detection of noise, such as film shot noise, in the image, and in particular the differentiation between such noise and microcalcifications.



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PCT/GB 00/00617

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p style="text-align: center;">---</p> <p>US 4 907 288 A (SHIMONI YAIR) 6 March 1990 (1990-03-06)</p>	1,2,4,5, 7,8,10, 12,13, 15,23,29
A	<p>abstract</p> <p>column 2, line 21 - line 29</p>	3,6,9, 11,14, 16-22, 24-28, 30-34
A	<p style="text-align: center;">---</p> <p>US 5 760 403 A (ELABD HAMMAM) 2 June 1998 (1998-06-02) abstract column 6, line 47 -column 7, line 60</p>	1-34
A	<p style="text-align: center;">---</p> <p>MOODY E B: "DISCRETE ORTHOGONAL POLYNOMIAL RESTORATION OF IMAGES DEGRADED BY SPATIALLY VARYING POINT SPREAD FUNCTIONS" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON IMAGE PROCESSING (ICIP),US,LOS ALAMITOS, IEEE COMP. SOC. PRESS, vol. CONF. 1, 1994, pages 680-684, XP000522708 ISBN: 0-8186-6952-7 abstract paragraph '000I! paragraph '00II!</p>	1-34
A	<p style="text-align: center;">---</p> <p>EP 0 788 070 A (EASTMAN KODAK CO) 6 August 1997 (1997-08-06) abstract</p>	1-34
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A	<p style="text-align: center;">---</p> <p>US 4 763 343 A (YANAKI NICOLA E) 9 August 1988 (1988-08-09) abstract column 7, line 1 - line 21</p>	35-66
A	<p style="text-align: center;">---</p> <p>US 5 757 880 A (COLOMB DENIS) 26 May 1998 (1998-05-26) abstract column 2, line 36 - line 59 column 4, line 56 -column 5, line 20</p>	35-66

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB 00/00617

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-34

Correcting a digital X-ray image for degradation caused by the digitizer Modulation Transfer Function

2. Claims: 35-66

Calculation of the compressed thickness of a breast from a mammogram

# INTERNATIONAL SEARCH REPORT

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International Application No

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